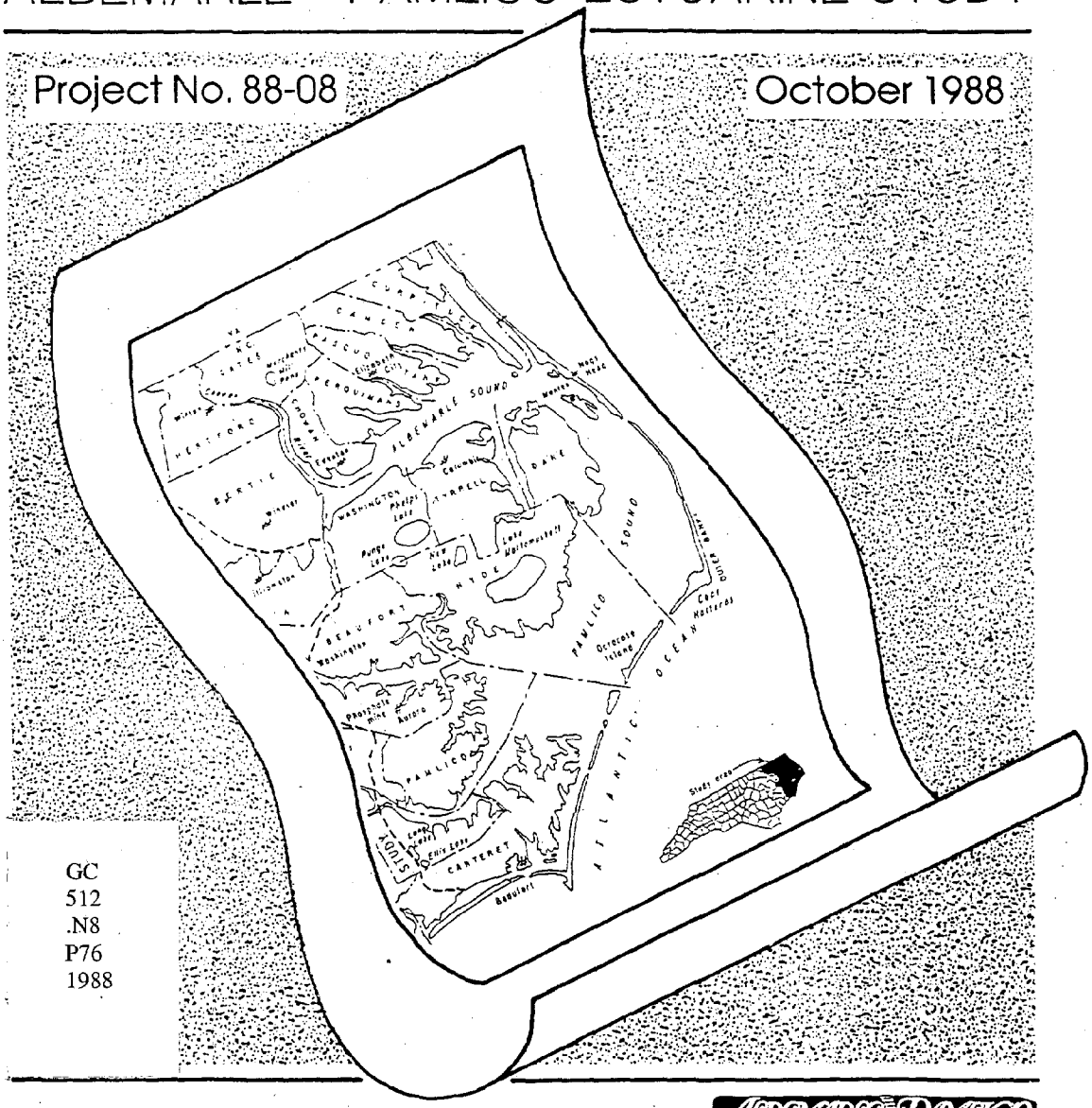
PROJECT ABSTRACTS

FOR THE PERIOD 1987--1989

ALBEMARLE - PAMLICO ESTUARINE STUDY

Project No. 88-08

October 1988



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ALBEMARLE-PAMLICO

PROJECT ABSTRACTS

For the Period 1987 -- 1989

Edited By

Robert E. Holman
APES Project Director

Project No. 88-08

October, 1988

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PROJECT ABSTRACTS FOR THE PERIOD 1987-1989

This report is a compilation of 45 project abstracts covering the period from 1987 to 1989. The period includes funded projects during fiscal year 1987-1988 and 1988-1989. Abstracts are organized according to the six major categories of information required to facilitate effective management of the program. These categories include resource critical areas, information management, fisheries, water quality, public participation and human environment.

Resource critical area category includes projects designed to identify specific areas where conflicts between affecting and affected uses are most significant. Projects designed to reduce those conflicts by effective management of these critical areas are also included. Information management efforts will be to provide users with access to data that will aid in addressing the issues associated with each category. The ability to effectively manage the data will be critical to the program's success. Fisheries category consists of projects intended to relate major changes in fisheries health and productivity to human activities. The fisheries processes are isolated from other estuarine relationships because of two specific fishing related phenomena of declining landings and fish diseases which require special attention. Water quality category includes projects designed to examine the causal relationships between human activities, significant instream modifications and the ramifications of changes for estuarine-dependent human activities. This category includes management-oriented investigations of major water quality processes and conflicts. Public participation is being addressed by an active public participation/public awareness program. Participation is intended to facilitate communication between the public and program administration; to marshal support from local governments and regional institutions; and to allow dissemination of information gathered through this study. The success of this first phase of the program (develop a comprehensive conservation management plan) will determine whether the second phase (implementation of the conservation management plan) will become a reality. The final category of human environment involves projects which examine the trends and patterns in the intensity of human uses and the institutional climate where management plans must operate.

These six categories of information gathering and dissemination must be pursued for effective management to take place. There must be an improved understanding of causal connections between human activities and changes in the estuaries for proper management pressure to be exerted on critical relationships, in order to reduce conflicts between competing uses.

Critical Area

ANALYSIS OF PAMLICO AND ALBEMARLE SOUND NURSERY AREA DATA

A B S T R A C T

By

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Estuarine nursery areas are habitats in which, for reasons such as food, cover, bottom type, salinity, temperature, and other factors, young finfish and crustaceans spend the major portion of their initial growing season. These shallow, protected, usually vegetated or muddy, detritus-filled creeks and bays are present along the entire periphery of Pamlico and Albemarle sounds. The spot, croaker, flounder, weakfish, menhaden, shrimp, anadromous fish and other species that depend on these waters for their survival contribute more than 90% of North Carolina's commercial fisheries landings each year and a great majority of the recreational catch, as well.

To protect the integrity and resources of these nursery areas, present state regulations prohibit the use of most bottom-disturbing fishing gears and severely restrict or prohibit excavation and filling activities for 81,954 acres officially designated as Primary Nursery Areas. Thousands of additional acres of estuarine nurseries are not yet classified nor are they adequately protected. These areas include anadromous fish spawning and nursery areas, nursery areas in Inland Waters, areas with submerged aquatic vegetation, and shellfish beds.

The North Carolina Division of Marine Fisheries (DMF) has conducted estuarine trawl surveys and juvenile assessment monitoring since 1970. A comprehensive analysis of these data will facilitate the development of critical habitat criteria to establish and protect fragile estuarine areas which support juvenile populations of economically important seafood species.

Documentation and compilation of available data has been completed. Coordination meetings with DMF, North Carolina Wildlife Resources Commission, Division of Environmental Management, and North Carolina State University biologists have been held. Data analysis is ongoing. Critical habitat criteria to be developed by June 1989.

ENVIRONMENTAL DETERMINATION OF OYSTER SUCCESS IN THE PAMLICO SOUND

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The oyster industry in North Carolina is based on the success of populations of the american oyster Crassostrea virginica. Wild populations were an important source of high-quality oysters in the last century. However, over-harvesting of these populations and a lack of an effective management program lead to a precipitous decline in harvest during the first half of this century even as the dollar value of the catch increased. A program of shell (cultch) planting was initiated by the Division of Commercial Fisheries in the late 1940's in order to provide substrata (empty shells of oysters and scallops) for larval settlement and to increase the size of oyster populations.

The success of a particular planting will vary due to factors affecting the success of oyster recruitment, as well as factors affecting the growth and survival of juvenile oysters. Accordingly, we are studying how the environment (location, depth, and salinity) affect the recruitment, growth, and survival of oysters.

In May 1988 we selected 12 study sites on major oyster areas in Pamlico Sound, 6 at high and low salinity sites, respectively. At each site mats were placed in shallow (3 feet) and deep (8 feet) water. Plastic mats with clean oyster shells attached to them were deployed at each location. At 3 week intervals the mats were retrieved and all settled spat counted and measured. Salinity, temperature, and sedimentation rate were also estimated.

Preliminary results indicate that spat settled earlier at sites were salinity was highest. Recruitment was observed beginning in June at these sites, while recruitment at the low salinity sites was delayed until September. Recruitment was very uneven in time; asynchronous peaks in spat abundance were observed at the various sites throughout the summer. Recruitment was also higher in the deeper areas at each site. Most spat were found on the bottom facing surface of the shells used as substrate.

Our studies will contribute not only to the knowledge of basic oyster ecology but also should lead to a more efficient use of sites and an eventual increase in production.

DESCRIPTION AND ECOLOGICAL IMPORTANCE OF FRINGE SWAMPS IN ALBEMARLE SOUND

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The forested wetlands that border Albemarle Sound and its tributaries are largely undescribed and their ecological importance is not well known. The purpose of this study was to assess the locations, quality, and species composition of wetland forests in a zone that is influenced by water level fluctuations in the sound. The zone appears to be up to 200 meters wide. Surveys showed changes in tree species from shoreline to the swamp interior. The forest actually begins in the water beyond the shoreline where cypress trees were stranded as a result of erosion and differential loss of other species. Moving into the forest, a slightly elevated storm levee is first encountered before the sequence eventually grades back into the lower-lying swamps of black gum and red maple. Even further inland where the hydrologic influence of the sound is diminished, vegetation may assume a shrubby appearance. Although there are wide variations in the details of this pattern among geographic locations, this zonation seems to hold for many places around the sound.

Information about these wetlands is important from several perspectives. First, they represent a resource of unquantified abundance whose shoreline position makes them potentially important habitat for fish and wildlife. Second, erosion of these shorelines raises questions about whether wetlands of the region are diminishing or maintaining a constant area. For the latter condition, landward migration of wetland must occur to compensate for losses by erosion. The ecological and socioeconomic consequences of landward migration have not been addressed in North Carolina. Third, sea level rise is the driving force that maintains the presence of wetlands in the region and sedimentation is necessary to prevent wetlands from drowning. It is not known what kinds of disturbances in this zone might pose a threat to sediment accumulation and thus be unacceptable.

Around 1967 the Currituck Sound and adjoining waters were infested with Eurasian watermilfoil from the Chesapeake Bay. This caused many serious problems in the area. In 1978, there was a drastic decrease in milfoil in the area and it has caused few problems since. We attributed this primarily to unusual weather conditions in the spring 1978. Heavy rains resulted in high runoff and turbid water which reduced light penetration and decreased photosynthesis. This was also a period of low water temperatures and high winds.

In 1988 the frequency of all but one species found in 1978 was much lower than for 1978 and appeared to be lower than for 1987. The cause of this reduction in plan occurrence at the study stations is not known.

Plant biomass (plant material) decreased dramatically in the Pamlico River around 1978-1980. Only one seagrass was found in the Pamlico River in 1985 with a total biomass only around 1% of that found in a 1975 survey. We attribute the decrease in species and biomass in the Pamlico River to the conditions prevailing in 1978.

In the summer of 1987 traces of wild celery, which comprised over 85% of the biomass in 1975, were found in the middle reach of the river. In 1988 wild celery was found in scattered clumps ranging from a few plants to several square meters. Smaller amounts were found across the river at Camp Leach. Traces of other species were found in 1988, one of which was last seen in 1973. We do not know what led to the reappearance of these plants. We do know from other studies that biomass of seagrasses varies widely on both the short term and the long term.

Attempts to transplant wild celery and other species into the Pamlico River were unsuccessful in 1987. Wild celery was successfully transplanted into the River in 1988. Growth was best in an area where there was heavy natural reestablishment of the plant.

ACKNOWLEDGEMENT:

The 1987 research was supported by a grant from Texasgulf Chemicals.

Obstructions to Anadromous Fish Migration

Abstract

Anadromous fish stocks (striped bass, hickory shad, American shad, alewife, blueback herring) are in a state of decline in the Albemarle-Pamlico Estuarine Study area as well as throughout much of their historic range in the United States. The reasons for this decline may be complex, but a primary and probably the most long-standing cause is the physical blockage of upstream movement of prespawning adults by man-made dams, constrictions associated with road crossings and natural obstructions such as beaver dams or log jams. The objectives of the study are to determine of the historic extent of anadromous fish excursion in the study area, to determine areas which are presently being utilized as anadromous fish habitat, and to identify barriers to the upstream and downstream migration of anadromous fish. The methods used to accomplish these objectives include interviews with recognized experts, review of the literature, aerial surveys and ground surveys.

Preliminary results of the inquires and surveys show that 78 percent of the obstructions to migrating fish are caused by man-made dams, 12 percent by road crossings and 10 percent by natural obstructions. In considering the possibility of restoration of anadromous fish and the role of obstructions in that effort, the percentages listed above suggest that most emphasis should be placed on ways to move fish past man-made dams. We believe this is true for the large stream-using fish such as striped bass, hickory shad and American shad. However, the smaller stream-using fish, including alewife and blueback herring, may be more affected in the future by changing trends in road crossing construction. Both old bridge replacements and new crossings are being accomplished with culverts rather than bridges, and in many cases, this results in upstream blockage. So, not only should we look to restoration of habitat, but we also should be vigilant to avoid further losses of spawning habitat.

The products of the investigation are maps depicting historic and present anadromous fish utilization of Albemarle-Pamlico Estuarine Study streams and impediments to or blockage of fish movements. A narrative describing in detail the types and locations of obstructions also will be included. This information will be be particularly useful to management and regulatory review agencies as well as to the development community because by identifying areas of concern, actions which might further degrade the fishery can be avoided and procedures for restoration and/or mitigation of fish passage may be designed.

Prepared by:
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SEAGRASSES IN THE ALBEMARLE PAMLICO ESTUARINE SYSTEM

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Marine species of submerged aquatic vascular plants (SAV), form underwater nurseries, seagrass meadows, for estuarine-dependent commercially and recreationally harvestable fish and shellfish. In North Carolina about 90% of commercial landings are composed of estuarine-dependent species. Overall, the most productive habitats for marine fish and shellfish in the Albemarle/Pamlico estuarine system (APES) study area are the shallow saline waters on the eastern periphery of Pamlico Sound and all of Core Sound. These productive shallow bottoms are inhabited by seagrasses: the temperate species, eelgrass (Zostera marina), the sub-tropical species, shoalgrass (Halodule wrightii), and the broadly distributed widgeon grass (Ruppia maritima). The co-occurrence of these three seagrasses is unique to North Carolina and provides critical fishery habitat, food and protective cover, throughout most of the year in waters as deep as 6 ft (MLW). We estimate a total area of marine SAV of approximately 200,000 acres for all of North Carolina, including Bogue and Back Sounds. Of this total, 14% is in Core Sound and 80% is along the eastern periphery of Pamlico Sound.

Under funding from APES we conducted an aerial survey (Dec. 1987) of Core Sound and eastern Albemarle and Pamlico Sounds and photographed (April 1988) Core Sound and eastern Pamlico Sound (both color and infrared at scales of 1:24,000 and 1:50,000). We collected seagrass samples (Oct. 1987 and March 1988) in Core, eastern Pamlico, Croatan, Roanoke, eastern Albemarle and Currituck Sounds to provide ground level verification of our photographic interpretation of SAV. As a demonstration product, we delineated SAV in 1985 photography of southern Core Sound and produced charts of seagrass habitat in Core Sound from Cape Lookout to Drum Inlet. These charts are based on USGS quadrangles and include navigational aids from NOAA nautical charts.

The charts and photographs we are generating form a baseline of location and abundance of this critical fishery habitat for temporal and spatial trend analysis, environmental impact evaluation and research on functional studies of the relationship between habitat and fisheries productivity. They already have provided valuable information to habitat managers in their review of dredge and fill related permit applications and helped achieve the nomination of Core Sound and western Bogue Sound for designation as outstanding resource waters.

Project Abstract

REGIONAL INVENTORY AND PROTECTION PLAN FOR CRITICAL NATURAL AREAS, WETLAND ECOSYSTEMS, AND ENDANGERED SPECIES HABITATS OF THE ALBEMARLE-PAMLICO ESTUARINE REGION
PHASE ONE

The Natural Heritage Program, a unit of the NC DNRCD Division of Parks and Recreation, has been awarded an APES grant for $59,500 to conduct a reconnaissance inventory to identify, describe, map, prioritize, and make protection recommendations for special natural areas, exceptional wetland ecosystems, and endangered and rare species habitats in ten counties adjacent to the Albemarle Sound. The counties to be surveyed in this phase of the project are Currituck, Pasquotank, Camden, Perquimans, Chowan, Gates, Hertford, Bertie, Martin, and Washington counties. No comprehensive surveys and mapping of primary natural areas have been previously accomplished for eight of those ten counties; the project will update natural areas information for Gates and Washington counties which were incompletely surveyed by the Natural Heritage Program in 1981-1982.

The N.C. Nature Preserves Act delegates responsibilities to the Natural Heritage Program for maintaining the statewide inventory of important natural areas and rare species habitats. However, state funding levels have been insufficient to enable the program to undertake systematic resource inventories and protection plans on regional bases, except for scattered counties in other parts of the state. The APES grant will enable the program to assemble information crucial to determine ecological resource protection priorities for the Albemarle region.

Experienced Natural Heritage staff scientists will supervise and direct the project. The Natural Heritage Program will hire or contract one research biologist as principal investigator for the project and employ other biologists as survey assistants. Their assignments will be to consult agencies and knowledgeable individuals for existing resource information, through a screening and preliminary review process to select potentially significant natural areas, conduct detailed site surveys, compile resource inventory reports and maps for all important natural areas and rare species habitats using report formats already developed by the Natural Heritage Program, make protection recommendations for each priority site, and prepare a summary evaluation report for the project. Boundaries of important natural areas will be mapped for the Land Resources Information Service. Data from the project will be recorded in the Natural Heritage Program's central inventory management system, which is used by many other agencies for environmental impact assessment, land use planning, resource management decisions, and conservation planning.

The Natural Heritage Program proposes to conduct additional inventories for the counties of the Pamlico Sound region and inner counties of the study region and to implement natural areas protection plans and identify and contact landowners as future phases of the APES project.

APES Project Abstract - 1988-90 Project by Charles H. Peterson of UNC Institute of Marine Sciences
"Mitigation for the losses of North Carolina bay scallops to the 1987-88 red tide outbreak"

The 1987-1988 outbreak of red tide in coastal North Carolina closed shellfishing from the Cape Fear River to Avon for up to 4 months and created a major economic hardship for eastern North Carolina. The red tide prevented normal harvest of oysters, hard clams, and bay scallops, but it also caused direct mortality of bay scallops. Over 50% of adult scallops died, but by far the greatest impact fell upon the new recruits, with numbers reduced to about 2% of normal years averaged over all of Bogue and Back Sounds. Only in central Core Sound and possibly in Pamlico Sound scallop grounds were recruit densities near normal.

This new project will determine whether there is a need to replenish bay scallops in historically important areas where they have been wiped out by the red tide. These beds include the commercially most important bay scallop beds in North Carolina, contributing up to 80% of the usual commercial catch. We will test the biologic and economic feasibility of collecting newly settling bay scallops on spat collectors temporarily anchored in surviving bay scallop beds in Core and Pamlico Sounds. We will then measure the survival of these seed scallops when reintroduced into depleted areas, comparing different seed scallop sizes, dates of reintroduction, and geographic locations, to assess the bioeconomic feasibility of stocking bay scallops in depleted areas. This study will also map all existing bay scallop beds in North Carolina and determine how much they vary from year to year.

Data Management

ABSTRACT
ALBEMARLE PAMLICO ESTUARINE STUDY
INFORMATION MANAGEMENT

The goal of the data management program of the Albemarle Pamlico Estuarine Study is to provide management support for the objectives of the overall Study. In this regard, the program will furnish natural resource managers and researchers with information to directly aid in addressing the issues of the region.

OBJECTIVES

The objectives of the Albemarle Pamlico Estuarine Study data management program are:

1. to catalog and assess the literature and data about the region.

2. to establish institutional and electronic mechanisms for accessing, integrating, and analyzing pertinent automated data.

3. to provide resources for automating data developed by the Study or required by the Study.

4. to develop data reporting and tracking systems that regularly summarize the conditions of the estuarine area.

THE DATABASES

The data management program utilizes existing databases to the maximum extent possible. A specialized database for the Study is also being developed. Software and procedures for accessing datasets residing on host computers other than the APES primary system are being developed so that users needing to combine detailed data from different computer systems may do so.

The database will have three basic components: a catalog of literature and data, column-formatted data, and geographic data. The literature and data catalog will function as an index to all of the known literature and data about the Albemarle Pamlico. Cross references between research reports and data generated by the research will be provided.

The APES database will contain data in tabular or columnar form from existing large datasets. Specifically the datasets include STORET, EPA's hazard waste database, the State's Permit Compliance System, U. S. Geological Survey's WATSTOR, and the N. C. Division of Marine Fisheries' database. The determination of data elements from these datasets to be incorporated in the APES database is be a first year activity. Other tabular data identified in the first year scoping studies may be included in the database also.

Almost without exception, the tabular data described above can be considered geographic data in that each data element is associated with a location on the surface of the earth, such as a discharge location or sampling site. Most data also contain coordinate locations (e.g. latitude and longitude) for each site that can serve as the basis for geographic datasets. Therefore one of the first geographic data layers to be entered into the system will be the station locations from those datasets.

Digitized base map data for the region will be stored in the system. The official base for the Albemarle Pamlico Study will be the USGS 7.5 minute topographic quadrangle maps. Additionally, the geographic data include general and detailed soil surveys, land use and land cover information, watershed boundaries (drainage basins), and geographic data about the marine fisheries of the state. The fisheries data includes primary and secondary nursery areas; anadromous fish spawning and nursery areas; shellfish areas; biological monitoring sites; submerged aquatic vegetation; etc. Census boundary map data and associated population, housing, income and employment data will be incorporated in the APES database.

THE COMPUTER SYSTEM

A computer system for managing data has been designed to serve the needs of the Albemarle Pamlico Estuarine Study.

In designing a system for the study, a number of design objectives were identified.

1. A geographic information system must be an integral part of the data system for the Study. The capability for compiling, storing, displaying, and analyzing geographic information is a requirement.

2. The system must minimize duplication of hardware, software, and data. Duplication will add unnecessary costs to the project, and can pose potential data integrity and consistency problems.

3. The system must support effective interfaces with existing computer systems.

4. The system must provide local and remote access to users. Managers and researchers from many different government agencies and universities, both within and outside the project area, must be able to use the data management system.

5. Flexibility is a system requirement. Because the identification of data needs will be an on-going activity of the Albemarle Pamlico Estuarine Study, the system must be flexible enough to manage both new and existing data, to permit ad hoc queries, and to facilitate database design adaptations. The system must also be flexible enough to permit and accommodate easy use by managers, technicians, and scientists.

6. The system must be developed in a cost effective manner.

7. The active utility of the system must extend beyond the life of the Albemarle Pamlico Estuarine Study. The system must be potentially self supporting at the conclusion of this Study.

The system for the Albemarle Pamlico Study consists of a primary computer system which will be connected both to existing systems and to remote users. The systems will be used to maintain the APES database and for general data management, geographic data analysis, statistical analysis, and literature and data cataloging.

The primary system utilized for the Study is the system operated by the Land Resources Information Service (LRIS) in the N. C. Department of Natural Resources and Community Development. Connections are being developed with EPA's National Computer Center (NCC), and the State's mainframe at State Information Processing Services (SIPS). If required, connections to the Triangle Universities Computation Center (TUCC) and the USGS computer systems will also be developed.

A custom "front-end" software package is being designed and developed. The front-end system will provide a management oriented interface to the data and will pre-process and integrate disparate data from existing databases. The software will also include programs for producing regular reports from the databases.

Users with authorized accounts may access the APES database and the primary system in several ways. Terminal access will be supported for users desiring to dial-in and query the database. Users may also access the system through the use of PC-based workstations where subsets of the database are downloaded to the user's system. Users may also be provided with information from the system through projects with LRIS in which the LRIS staff produces a final product from the database.

Fisheries

SCOPING STUDY OF DATA REQUIREMENTS FOR FISHERIES STOCK ASSESSMENT IN NORTH CAROLINA

A B S T R A C T

By

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Stock asessments are very important to the management of North Carolina's marine fisheries. The purpose of assessment is to determine the past and current status of a stock and provide insight into the effects that changes in management practices or the fishery will have on the future stock condition. To conduct stock assessments, biologists need various kinds of biological and statistical data. Currently the Division of Marine Fisheries, National Marine Fisheries Service, and other organizations collect these types of data. This project is to identify needed data types, evaluate the available data, and recommend needed adjustments in existing data collection activities. The recommendations will be based on the goals and objectives of the Division of Marine Fisheries, the types of data needed for stock assessments, and the available data and their quality.

The overall management goal for the fisheries resources is to preserve, protect, and enhance the resource in order to derive the greatest possible economic and social benefits (optimum yield). Individual species or fishery management objectives are based on the apparent stock status, current and past landings, regulatory jurisdiction, and social/economic needs. The data requirements for stock assessments include stock identification; commercial and recreational fisheries landings and effort; fisheries independent survey data; and size, age, and sex data. The data are used to estimate such fishery parameters as growth, abundance by age and size, mortality (fishing, natural and total), fecundity, recruitment, and rate of reproduction. Management goals and objectives have been identified. The available data are now being identified and evaluated as to their quantity and quality. Recommendations for modification in data collection activities and additional data needs for the future will be made.

EVALUATION OF TRAWL EXCLUDER DEVICES IN THE PAMLICO SOUND SHRIMP FISHERY

A B S T R A C T

By

Kenneth B. Pearce, David W. Moye, and Steven K. Strasser

1988. Albemarle-Pamlico Estuarine Study, Project Number 154, 42 pages

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The Scottish Separator Trawl, Florida Fish Excluder, Georgia turtle excluder device (TED), and the Parrish TED were tested to determine their effectiveness in reducing the bycatch of scrap (unmarketable finfish) taken by shrimp trawls in Pamlico Sound, NC during the fall of 1987. In addition, the retention of shrimp was examined in the four gears. A 50 ft shrimp trawler, pulling two 55 ft shrimp nets, was employed using a randomized block design so that each experimental net could be tested against the others and a control. All work was done at night, and the primary target species was pink shrimp (Penaeus durorarum).

Analysis of variance (ANOVA) was used to determine significant differences in mean values (using weight (kg) and percent).

In terms of overall bycatch reduction, the Georgia TED, Florida Fish Excluder and the Parrish TED showed a significant reduction when compared to the control. Neither the Georgia TED nor the Florida Fish Excluder showed significant differences in shrimp weights when compared to the control net. The Florida Fish Excluder would be recommended over the Georgia TED due to its ease in installation and smaller size. The Scottish Separator Trawl may be better suited for use in the ocean trawl fishery off North Carolina and the mid-Atlantic states to separate flounder from midwater species, as was evident in this study.

Extensive work is needed in inshore waters with the Georgia TED, Florida Fish Excluder and other fish excluders or efficiency devices to determine the optimum gear for the shrimp fleet in Pamlico Sound. Until this research can be completed, it is recommended that shrimpers in Pamlico Sound use the Florida Fish Excluder to reduce bycatch.

Title: **The Value of Recreational Fishing on the Albemarle and Pamlico Sounds**

Principal Investigators: **V. Kerry Smith and Raymond B. Palmquist**

Abstract:

The objective of this project is to develop economic models of how individuals use the Albemarle-Pamlico Sounds for recreational fishing. In the process we sought to describe demands for marine fishing. These models would be used to evaluate one aspect of the benefits people would realize from improvements in the quality of these resources, and management policies directed to reducing the effluent loading entering the sounds could then be evaluated.

This work has found that the recreational fishing for the area involves primarily residents of coastal or nearby counties. Demand models have been sucessfully estimated for two broad usage areas - the Pamlico and Outer Banks regions. Based on these estimates, our preliminary findings suggest that a typical fishing trip to the area was valued at between $30 and $60 (in 1982 dollars). Our results incorporating the features of the resource as an influence on decisions involving fishing trips has been somewhat less successful, with the specific results depending on the model selected. Some encouraging estimates have been developed for the Outer Banks region indicating that quality measures are important to experienced fishermen.

Moreover, related work with these same data sponsored by the North Carolina Sea Grant has been influenced by our early findings. It has used an alternative framework. Based on preliminary findings, this research shows considerable promise. These results suggest that once the local, single-trip orientation of the recreational decisions was specifically incorporated into the model, proxy measures for the characteristics of the areas were found to be important to the recreational decisions of all households, not exclusively to the experienced recreationists. The work remains preliminary but offers the prospect of gauging how specific improvements at individual locations along the coast might influence the patterns of use of these areas and the benefits derived by the recreationists involved.

ABUNDANCE AND VIABILITY OF STRIPED BASS EGGS SPAWNED IN THE ROANOKE RIVER, NORTH CAROLINA, IN 1989

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Department of Biology
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This study, which will not be initiated until April 1989, is the second year of work begun in 1988. The intent of the study is to continue a 30-year data base established by Dr. W.W. Hassler of N.C. State University on spawning success of striped bass in the Roanoke River watershed below the Roanoke Rapids dam near Weldon, North Carolina. In mid-April, waters of the Roanoke River above the Scotland Neck bridge (NC 258) will be sampled with fine-meshed egg nets every 4 hours for 60 days to determine the abundance and viability of striped bass eggs deposited on the spawning grounds farther upstream. Once fertilized, the eggs develop as they are transported downstream by the currents. Total egg production and overall viability for the 1989 spawning season will be estimated. This information will be used as a relative indicator of spawning success for studies farther downstream to determine larval and juvenile abundance later in the season.

FOOD AND FEEDING OF LARVAL FISHES IN THE LOWER ROANOKE RIVER AND WESTERN ALBEMARLE SOUND, NORTH CAROLINA

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Based on results of our larval striped bass research from 1982 to 1988, we believe that there is an inadequate food supply in the Roanoke River for finfish larvae, especially striped bass, which limits successful formation of strong year classes of striped bass in western Albemarle Sound. We believe that this inadequacy is the result of: 1) low food abundance (i.e., low zooplankton densities), and 2) food quality (size and mobility of prey). Zooplankton is not uniformly distributed throughout the lower Roanoke watershed but is highly concentrated only in several specific locations. In past years, larval striped bass have not fed successfully because their abundance was mismatched in both space and time with the highest zooplankton concentrations. Apparently, the manner in which striped bass larvae move through the Roanoke delta on their way to the historical nursery grounds in western Albemarle Sound is dictated by the prevailing water currents, which may or may not correspond to peak zooplankton abundance. This phenomenon does not prevail for other larval finfish species. By examining these other species, we will be able to answer the question, "is poor feeding success a result of food concentration, food quality (size and mobility), or timing between the presence of food and initiation of feeding?"

The objective of this project, scheduled for initiation in October 1988, is to determine the feeding success of larvae of various fish species collected in the critical habitats of the lower Roanoke River and western Albemarle Sound from 1982 to 1986. Information obtained by examination of these preserved specimens will be compared to the zooplankton community present at the same time and location. These analyses will be compared to results obtained for larval striped bass feeding success during the same period. In Year 1 of this study, we will examine larvae collected in years 1982, 1983, 1984, and a portion of 1985, then compare the data obtained with the historical zooplankton data base stored in the ECU mainframe computer. In Year 2, we will complete the study by examination of years 1985 and 1986. It is important that all five years of the collection be used to ascertain the effects of water flow (i.e., discharge from the Roanoke Rapids Reservoir) on larval fish distribution and feeding success.

WATER QUALITY AS A FUNCTION OF DISCHARGE FROM THE ROANOKE RAPIDS RESERVOIR DURING HYDROPOWER GENERATION

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A study designed to examine how various water quality parameters of the Roanoke River change as a function of discharge from a reservoir was undertaken in the spring of 1988 as a cooperative effort between East Carolina University and Weyerhaeuser Company. Sampling effort was matched with that of a study on abundance and viability of striped bass eggs spawned in the spring of 1988. Water samples were collected for one 24-hour period each week at two locations: one site near Scotland Neck, North Carolina, just downstream of the major spawning grounds; and the second area in the Roanoke delta near the town of Plymouth. Scotland Neck samples were collected six times (every four hours) over the 24-hour period every two weeks. On the alternate weeks, one composite sample was collected for the 24-hour period. Roanoke delta samples were collected at four locations once each week. The study was initiated on 14 April and was terminated on 8 June 1988.

As of this writing, a number of the last series of samples are waiting to be analyzed for heavy metals; however, enough information from all samples is available to list some of the preliminary results. The spring of 1988 appears to have been an excellent year for establishing baseline data on Roanoke River water quality. Water release from the Roanoke Rapids Reservoir was held between 6,000 and 9,000 cfs for duration of the study, which is the flow regime recommended by the Roanoke River Water Flow Committee as optimal for survival of striped bass eggs and larvae. Water quality throughout the study remained stable and rather "bland"; no strange or unusual water quality parameters were noted. Nutrient levels (e.g., phosphates, nitrites, nitrates) were indicative of an oligotrophic system. Alkalinity was low, indicating that the system is poorly buffered. The pH of the waters remained near 7.0. Heavy metal analysis did not reveal any element present in high concentrations. Diel variability and seasonal variability of water quality parameters have not been analyzed. We believe that the stable water release schedule was a contributing factor to the good water quality observed in 1988, which in turn contributed to the highest viability of striped bass eggs observed since the late 1970s, and the best index of juvenile abundance in western Albemarle Sound since the mid 1970s.

ABUNDANCE AND VIABILITY OF STRIPED BASS EGGS SPAWNED IN THE ROANOKE RIVER, NORTH CAROLINA, IN 1988

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Studies on striped bass egg abundance and viability have been conducted in the Roanoke River each year since the mid-1950s by Dr. W.W. Hassler and co-workers from North Carolina State University in Raleigh. The information gathered by these researchers spans nearly 30 years of uninterrupted records and is well-known as the best data base on striped bass spawning activity in North America. These records have been an extremely important source of information for reconstructing the historical spawning record in relation to exploitation, changes in regulations, and man-induced changes in the flow regimen and water quality for the Roanoke River. Upon the retirement of Dr. Hassler in 1987 from actively pursuing these studies, the APES program ensured continuation of the egg production data base by funding the study through ECU in 1988.

The objectives of the study are: 1) to continue the data base established by Dr. Hassler; 2) to develop a means to back-calculate Hassler's data in an egg density-per-unit-volume format (to compensate for radical changes in the flow regimen); and 3) to correlate the intensity of striped bass spawning (as measured by egg production) with water releases from the reservoir at Roanoke Rapids, North Carolina.

Sampling the waters of the Roanoke River for striped bass eggs was initiated on 10 April 1988 at a site below the historical spawning grounds just downstream of the Caledonia State Prison Farm near Scotland Neck, North Carolina. Samples were taken every four hours for a 60-day period. Eggs were collected in fine-meshed nets suspended in the water column for five minutes. The eggs were returned to the field station on the river bank, enumerated, and examined to determine viability. Diel and seasonal variability in the data remains to be analyzed. Over 89% of the scheduled sampling trips were completed; the remainder were not completed due to inclement weather and equipment problems. A total of 41,719 striped bass eggs were obtained in the 311 trips. Nearly 77% were examined for viability; during peak egg production, subsampling for viability was mandatory. Preliminary results indicate that total egg viability for 1988 was about 89%, the best value since 1972 (excluding values for 1985-87, which were not available). Total egg production for 1988 has not been estimated at this time. This high viability estimate corresponds with good 1988 water quality (determined by another APES study), moderate river flows, good larval striped bass abundance in the critical habitats of the lower river, and the best (estimated) juvenile abundance index since 1983.

Water Quality

Hyde County Soil Survey

APES is sharing the local cost of the North Carolina Cooperative Soil Survey Program in Hyde County. The purpose of the survey is to determine the nature and extent of the various soils in Hyde County. This inventory will provide basic land resource data necessary for making proper land use decisions. The data will support local, state and federal level efforts to protect and conserve the natural resources of the county. The potential of land areas will be determined relative to suitability for agriculture, forestry, residential and other uses.

The Hyde County Soil Survey is undertaken through the North Carolina Cooperative Soil Survey Program as a joint effort between the USDA, Soil Conservation Service, the North Carolina Department of Natural Resources and Community Development (NRCD) and Hyde County. Each level of government is responsible for about one-third of the survey's cost. NRCD and the Soil Conservation Service are providing a total of 7 man years of technical expertise. Hyde County is making a cash contribution of $60,000, half of which is funded through APES.

Hyde County has a land area of approximately 400,000 acres. Soils mapping was previously done on about 110,000 acres by Weyerhauser, the Soil Conservation Service and First Colony Farms, leaving about 290,000 acres for the Cooperative Soil Survey Program. The survey began in the fall of 1987 and is scheduled to be completed in the fall of 1990. The first years mapping goal of 45,000 acres has been met and much of the county soils legend has been established.

The soil survey identifies soil types on 1:24,000 scale aerial photographic base maps. Preliminary sheets will become available beginning in August 1989. A final document will be published by the Soil Conservation Service after the completion of the survey.

The Potential for Eutrophication and Nuisance Algal Blooms in the Albemarle-Pamlico Estuary: Principal Investigator Hans W. Paerl, U.N.C. Institute of Marine Sciences, Morehead City, N.C., 28557

The Albemarle-Pamlico Sound System (APSS) is North Carolina's most expansive, ecologically and economically-important water body, supporting diverse and valued marine and estuarine fisheries, recreational and tourism resources. All are highly dependent on desirable water quality and fertility. Based on recent documentation of accelerated algal production (eutrophication) in key APSS tributaries (Chowan, Pamlico and Neuse Rivers) periodically culminating in nuisance blue-green algal and dinoflagellate "blooms" (and associated bottom water oxygen depletion, toxicity and loss of fisheries resources), managers and the public are concerned how both water quality and fertility (productivity) may be affected by accelerating nutrient and sediment inputs in the APSS itself. Currently, little is known regarding either water quality status or the potential for eutrophication in the APSS.

Accordingly, the following informational and management needs are being addressed in this project; 1) Seasonally, what is the relative importance of nitrogen (N) vs. Phosphorus (P) as chief algal growth-regulating (limiting) nutrients? 2) What is the relative importance of sediment-associated vs. soluble nutrients as eutrophicating factors? 3) What combination of nutrient inputs and physical conditions (light, temperature, salinity) lead to and sustain nuisance algal blooms? 4) What is the potential for bottom water oxygen depletion during algal growth cycles? Using a combination of field monitoring, bioassay and experimental manipulations, results thus far show ; 1) Seasonally, N limitation exclusively occurs during summer and fall, while N and P co-limitation takes place during winter-spring. Hence, future management policies aimed at stemming eutrophication should consider seasonally-adjusted N and P input constraints. 2) Thus far (first 6 months of this project) no strong selection for nuisance blue-green algal or dinoflagellate (including red tide species) appear obvious in response to nutrient additions alone; we suspect that physical conditioning of the water column plays an additional, synergistic role in nuisance bloom development. 3) While some bottom water oxygen depletion appears during maximum algal growth periods, complete anoxia (total oxygen depletion) has not been observed. Further manipulative experiments are planned for year 2 to more thoroughly evaluate the potential for anoxia in response to N and P enrichment as well as the relative impacts of sediment input on algal bloom potentials. 4) Work in progress points to the importance of within system N regeneration in supplementing "new" N inputs as eutrophicating factors. 5) Lastly, eliciting N_2 fixing blue-green nuisance algae in response to high P loading is more likely among bottom and fouling as opposed to planktonic (suspended) algal communities in the APSS.

REDUCTION OF ESTUARINE NUTRIENT LOADING: N AND P REMOVAL IN COASTAL SWAMPS

By

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ABSTRACT

The estuaries of North Carolina sometimes exhibit symptoms of eutrophication: excessive algal growth, discolored waters, anoxic bottom waters, and fish kills. Control of eutrophication is essential for optimum use of these estuaries. Estuarine eutrophication depends largely on the amounts of nutrients coming off the land, but we know little about how efficiently nutrients such as sewage nitrogen and phosphorus are removed by forested swamps bordering Coastal Plain streams.

Assessment of nutrient removal from swamp stream waters requires careful selection of study sites. In the first year of the study, we determined major criteria for selecting good study sites: representativeness; presence of extensive floodplain; absence of disturbance; accessibility; logistical practicality; wastewater load appropriate to the stream discharge; and absence of large tributaries close below the outfall. These criteria were then used to evaluate a large number of possible swamp sites. We assembled existing information, gathered original data on field trips, and enlisted the help of wetland experts in order to narrow the original list of forty-nine potential sites to two sites.

Our plan for the next two years is to measure nitrogen and phosphorus concentrations above and below municipal wastewater outfalls every three weeks at the two sites. From the downstream changes in concentrations we shall calculate removal efficiencies. In addition, we shall do similar extensive studies (measurements twice a year at about ten sites) in order to evaluate differences from one swamp to another. The results are expected to aid in decision-making regarding both wastewater treatment and wetlands protection.

A Scoping Study of the Distribution, Composition, and Dynamics of Water-Column and Bottom Sediments: Albemarle-Pamlico Estuarine System

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Sediments are especially important to the management of estuarine waters because they may concentrate heavy metals, pesticides, or other toxic substances that adhere to their surfaces. In shallow water systems like the Albemarle-Pamlico Estuarine System, the water column and bottom sediments interact continually, exchanging and redistributing particles and solutes so as to impact the operation of the entire system. Unfortunately, many of the chemical and biological pollutants are temporarily stored in the most mobile sediments, the mud fraction, thus making for easy passage of these materials through the food web. The objectives of this scoping study were to take the first step in consolidating to a common scale on a base map what we know about bottom sediments and, through remote sensing techniques, to provide the first basin-wide glimpse of suspended sediments under different environmental conditions.

Our knowledge of the origin of the sediments and their composition and size is based on approximately 25 reports and journal articles published since the late 1950s. Data on sediment samples (location, type, size, composition) were taken from each of these reports, plotted by computer onto a series of large (30" x 30") base maps, and permanently stored in the data files of the N. C. Land Resources Information Service. Four sets of satellite images, collected during different seasons, are being photographically enlarged and studied for patterns of sediment movement under different conditions of wind and river discharge. Final sediment maps and satellite images will serve as: 1) a reference for benthic habitat studies where bottom sediments are a critical factor; 2) a first-order map set showing potential sites where sediments of different sizes and composition may be stored; 3) an index for sediment resuspension, where the resuspension of sediments is controlled by grain size; and, 4) a characterization of bottom type that can be used in mathematical models for water movement and sediment dispersal.

Conclusions drawn from the scoping study are that: 1) soft, mobil sediments are accumulating very rapidly in the estuarine parts of the Neuse River, Pamlico River, and in Albemarle Sound; 2) muds that escape the estuarine "trap" are confined to Pamlico Sound by the Outer Banks barrier islands and are simply recycled until finally coming to rest in the deepest part of the basin; 3) short-term wind, wave, and tidal processes are secondary to longer-term processes, such as sea-level rise and barrier island migration, in net movement of Albemarle-Pamlico sediments; and, 4) at the present rate of sediment input and sea level rise, the system will never become filled with sediments, as will most other east coast estuaries.

Water-Quality Trends of the Albermarle-Pamlico Estuary System--A Progress Report

Douglas A. Harned, U.S. Geological Survey

The objectives of this study are to identify, compile and analyze existing hydrologic and water quality data of the Albermarle-Pamlico estuary system (APES) in order to identify long-term temporal and spacial trends. Existing information on river and estuary water quality, agricultural land use and fertilizer use, and precipitation quality is being complied in a Statistical Analysis System (SAS) dataset. Additional data on land use, drainage density, and point sources will be complied as it becomes available.

The upstream boundary of the study area is defined by the watershed boundaries of the basins of the National Stream Quality Accounting Network (NASQAN) of the U.S. Geological Survey (USGS). Analysis of dissolved solids data from NASQAN stations on the Neuse River, Tar River, and Contentnea Creek shows a statistically significant increase of 1.5 mg/L per year over the last 20 years. Discharge data from these NASQAN stations is the best available long-term flow data for the APES system. A special effort will be made to relate the upstream water quality as monitored at the NASQAN stations to water quality in the estuary system. As part of this effort, monitors have been installed at the Neuse River at Kinston and Tar River at Tarboro NASQAN stations to continuously monitor specific conductance. The conductance data collected at these stations will allow comparison to data currently being collected at the USGS stations downstream in the estuaries.

Three principal sources of data supply water quality information for the APES area. A number of individual investigators have collected data for the system, the U.S. Environmental Protection Agency (EPA) database system STORET contains much of the N.C. Department of Natural Resources (NRCD) data, and the USGS database system WATSTORE contains NASQAN and atmospheric precipitation data of the National Atmospheric Deposition Program (NADP) network. A bibliography has been complied of reports by individual investigators for the APES area. Data from 25 of these reports has been entered into SAS data sets. Data has also been retrieved from WATSTORE for the seven NASQAN stations and is being obtained from STORET for most of the 450 stations listed in that database, including the NRCD Ambient Monitoring System. Maps of locations of the water-quality stations for the individual investigators and STORET data have allowed the identification of areas of missing data, and have helped break the region up into segments to ease water-quality comparisons. An examination of NADP data from the Lewiston and Clinton precipitation stations indicates that although pH of precipitation is low (around 4.5) there is no statistically significant trend over the last 10 years. However, water-quality variation in the rainfall may help to explain some of the water-quality variation observed in the estuary system.

Once the data set has been constructed the data will then be analyzed to determine spacial variation and temporal trends. Relationships between estuary water quality and agricultural land use, fertilizer use, precipitation quality, and other hydrologic characteristics will be examined. Both parametric and non-parametric statistical techniques will be employed to determine trends and to identify correlations.

Evaluation of Off-Site Changes in Hydrology and Water Quality Resulting from BMP's in the Albemarle-Pamlico Region

Jerad D. Bales, U.S. Geological Survey

The objectives of this investigation are (1) to quantify the effects of tide gates and flashboard risers on runoff and water quality (specifically sediment and nutrients) immediately downstream from drained agricultural fields and (2) to determine the effects of controlled and uncontrolled freshwater inflows on salinity in a Pamlico River nursery area.

Six study sites have been selected. Three sites are in Beaufort County east of Aurora, with two of the sites on adjacent ditches which are tributary to Campbell Creek. The third Beaufort County site is approximately five miles west of the other sites and is tributary to Bond Creek. A flashboard riser has been installed in one of these ditches; risers will be installed at the remaining two sites in about two years. Three additional study sites are located in Hyde County on adjacent ditches which are all tributary to Rose Bay Creek. A tide gate has been installed in one of the ditches; tide gate installation will follow at the other two ditches in about two years.

A water-level recorder, an automatic water-quality sampler, and a bi-directional, electromagnetic current meter with an electronic data logger have been installed in each ditch downstream of the planned or existing water-control structure. A water-level recorder has also been installed upstream of the existing tidegate and the existing flashboard-riser installation. Recording rain gages were installed near the Beaufort County sites and near the Hyde County sites.

Water-level information is being used to aid in designing the water-quality sampling program. Water-quality samples will be collected for about six high-flow events per year. The electromagnetic current meters are used to provide a continuous record of point velocity in the ditch. Continuous flow rates in the ditch will be calculated from the water-level data, the point velocity data, and a relation among point velocity, water level, and cross-sectionally averaged velocity. Flow data will be combined with water-quality data to estimate nutrient and sediment loads in the ditch.

A tidal gage and conductivity meter have been installed on Campbell Creek. In the coming year, five in situ, recording conductivity meters will be installed along the longitudinal axis of Campbell Creek. Data from these instruments (and from a companion study) will be used to investigate the mixing of fresh and saline waters in Campbell Creek.

Determination of Flows and Flow Patterns in the Pamlico River and Neuse River Estuaries

Jerad D. Bales, U.S. Geological Survey

The objectives of this investigation are (1) to collect, analyze, and interpret information needed to characterize the hydrodynamic conditions and to numerically model flows and flow patterns in the Pamlico and Neuse River Estuaries, and (2) to modify, calibrate, validate, and apply a two-dimensional vertically-averaged numerical model of the two estuaries to characterize flow and salinity patterns and to provide a continuous record of flows.

Five tidal gages have been installed on the Pamlico River Estuary between Washington and the confluence of the Pamlico and Pungo Rivers; tidal information from a gage located on Campbell Creek, as part of a companion study, is also being utilized in this investigation. Six tidal gages have been constructed on the Neuse River Estuary between New Bern and the confluence of the Neuse and South Rivers. All of the gages, which are located on the shoreline or at bridge crossings, are referenced to a common datum.

Three conductivity meters are in place in the Pamlico River; two conductivity meters are operating along the Neuse River. Installation of conductivity meters on aids-to-navigation was delayed at the request of APES in order to integrate data from this study with the monitoring program. Now that the monitoring program has been approved, construction of instrument platforms on the aids-to-navigation is essentially complete. Five water-quality monitors will be installed in the Pamlico and six monitors will be placed in the Neuse. The instruments will monitor conductivity and dissolved oxygen at three points in the water column; temperature will be monitored at one depth. Data from these monitors will be recorded by electronic data loggers. All water quality and tidal data are being recorded at fifteen minute intervals.

Bathymetric data for the two study areas has been obtained from the National Ocean Survey. The data have been placed in a geographic information system. Contour and three-dimensional plots have been developed, and the study areas have been gridded in preparation for numerical modeling.

A two-dimensional vertically-averaged numerical model is being modified for this application. Plans are to do some preliminary modeling in early 1989 in preparation for intensive velocity surveys to be conducted in the two estuaries. These surveys will involve continuous measurement of velocity profiles at about six sites for a period of about two days. About ten recording current meters will also be moored within the study reach for a period of about three weeks, which will include the time when profiles are being measured.

HEAVY METAL POLLUTANTS IN ORGANIC-RICH MUD OF THE PAMLICO RIVER ESTUARINE SYSTEM: THEIR CONCENTRATION, DISTRIBUTION, AND EFFECTS UPON BENTHIC ENVIRONMENTS AND WATER QUALITY

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Discharge of apparently low concentrations of heavy metals from both natural and anthropogenic point and non-point sources into coastal waters does not rule out pollution problems in estuarine environments. High adsorption capabilities of clay minerals and high chemical reactivity of organic matter, both major components of suspended and bottom sediments, continuously strip trace metals from the water column. The cumulative effect of large discharge volumes even with low concentrations over long time periods leads to metal enrichment. Storms, biological processes, and man routinely suspend the mud sediments into the water column. These processes concentrate the metals within bottom sediments to levels that are orders of magnitude above acceptable water level concentrations. The toxic metals are then potentially available for further concentration and movement through the food chain by abundant filter and detritus feeding organisms living within the organic-rich mud environments. The EPA list of pollutants of priority concern includes the following metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Our study concerns the concentrations of these, as well as 16 other metals in sediments from the Pamlico River Estuary. This will provide a basin-wide assessment of the extent of heavy metal pollution, a prerequisite essential for proper management and preservation of our estuarine resources.

Organic-rich muds were cored at 150 stations within the Pamlico River estuarine system reflecting a regional grid and known point and non-point sources within the basin. Each core (0.5 to 4.0 meters in length) has been subsampled at 10 to 30 cm intervals for subsequent chemical and physical analysis. Trace metal concentrations are being determined for 24 elements, including those on the EPA's list of priority pollutants. In addition, water content, particle size, and percent organic material are being measured. These data will be used to determine where heavy metals concentrate within the basin, as well as environmental conditions favoring heavy metal enrichment. Deeper cores are being used to determine pre-industrial and pre-agricultural conditions in N.C.

Results obtained to date indicate important spatial and temporal variability in heavy metal concentrations. Surface sediments have significantly higher concentrations (by factors of 3 to 6 times) of arsenic, cadmium, copper, lead, and zinc than sediments from deeper in the cores. Sediments from tributary creeks containing known point-source discharges, are enriched (from 5 to more than 30 times) in cadmium, chromium, copper, nickel and zinc compared to sediments from the main channel. These data suggest anthropogenic sources are partly responsible for metal enrichment throughout the estuary.

DEVELOPMENT AND ADMINISTRATION OF A SERIES OF TECHNICAL WORKSHOPS

Under a contract with the Albemarle-Pamlico Estuarine Study, The University of North Carolina Water Resources Research Institute developed and conducted a series of one and two-day technical workshops to critically assess priority issues for the Albemarle-Pamlico Estuarine Study. These work sessions provided a setting for scientific analysis by a multidisciplinary and interagency panel to examine in detail specific technical, and management issues.

The following workshop titles and the dates for each were:

- **Hydrodynamic and Water Quality Models for Estuarine Studies**
  September 3 and 4, 1987

- **Fish Diseases in the Albemarle-Pamlico Estuary**
  September 22, 1987

- **Remote Sensing and Geographic Information Systems for Use in Managing the Albemarle-Pamlico Estuary**
  November 9-10, 1987

The specific objectives of these workshops were:

1. To review approaches used in a variety of estuarine settings

2. To assess the State's current capabilities

3. To benefit from the experience of other agencies and universities that have attempted a similar approach

4. To review examples of expertise within the region

5. To recommend a practical strategy for addressing the problems as part of the Albemarle-Pamlico Estuarine Study

The workshops were successful in meeting these objectives. The workshops created a successful exchange of ideas among scientists and managers and provided clearer focus and a narrowing down of choices to be made. The 30-45 speakers and participants in each workshop represented the leaders and expertise in the selected subject areas. Experts included university researchers, and state and federal agencies both from North Carolina and from outstanding estuarine programs in other states.

Proceedings for these workshops have been completed and are in the process of being bound. These proceedings contain the papers presented at the workshop, a record of the discussion, and a summary and recommendations section.

Tyler, Mary. Versar, Inc., ESM Operations, 9200 Rumsey Road, Columbia, Maryland 21045. POTENTIAL FOR THE LONG-TERM PERSISTENCE OF THE RED TIDE DINOFLAGELLATE Ptychodiscus brevis IN NORTH CAROLINA COASTAL WATERS.

In October 1987, the toxic red tide dinoflagellate Ptychodiscus brevis which normally resides along the Florida coast was introduced into North Carolina waters via the instrusion of a Gulf Stream eddy. The resultant population caused the closure of shellfish beds in North Carolina due to the presence of brevetoxin in the shellfish. Many red tide organisms form resting stages during adverse conditions in which they sink to the sediment and regain their swimming form when conditions become more favorable. This cyst is most often associated with life cycle changes in which the cell commences sexual reproduction, including gamete production and cyst formation. The existence of a resting form for Ptychodiscus brevis is currently under debate; however, the distinct possibility that the initial inoculum had established a resident population of toxic organisms in the benthic sediments in North Carolina which could germinate and form blooms on an annual basis was addressed in the following way. A field sampling program was conducted the 9th through 11th of February 1988 aboard the National Marine Fisheries R/V Carolina Coast. Sampling areas included seven locations in the straits, three locations in Bogue Sound, nine locations in Morehead and Beaufort Harbors, and seven locations in the Beaufort Inlet area of the Atlantic Ocean. At each location, the water column was vertically sampled for organisms and profiles of salinity, temperature, pH, and dissolved oxygen were obtained. In addition, samples of sediment were taken at each of the 26 locations. Each was subdivided and one set incubated at room temperature immediately upon return from the field, while the other set was kept at field temperatures in the dark for 1 month (to simulate in situ conditions) prior to gradual warming to 20°C. Culture dishes were swirled daily for aeration and the overlying water monitored for the appearance of cells. Incubation of the samples yielded no motile population which indicates that one of the following is true: 1) Ptychodiscus did not form a resting stage in North Carolina waters, 2) Ptychodiscus formed a resting stage, however, its obligate period of dormancy was not complete during the short one month incubation, or 3) Ptychodiscus formed a resting stage which was not viable in North Carolina coastal waters.

ALBEMARLE - PAMLICO SOUND COUPLING STUDY

ABSTRACT

by
Leonard J. Pietrafesa
and
Gerald S. Janowitz

Albemarle Sound is a desert relative to Pamlico Sound in terms of fish population. While the cause of this phenomena of a lack of substantial fish colonization in Albemarle is at present not understood, two possibilities present themselves. Either fish larvae present in Albemarle Sound may not survive to maturity or there may be only a small number of estuarine dependent finfish larvae entering the sound. It is the second possibility we shall investigate by conducting field studies to examine the hydrodynamic coupling between Albemarle and Pamlico Sounds via Croatan Sound; with a two year period necessary to understand inter-annual variability. Oregon Inlet, which is the probable source of marine fish larvae for Albemarle Sound, supplies ocean waters and fish larvae to northeastern Pamlico Sound. By direct measurement we will determine whether the flow through Croatan Sound is or is not favorable for the abiotic transport of larvae from Pamlico into Albemarle Sound. If the flow is unfavorable for abiotic transport, improvements in water quality conditions in Albemarle Sound will have little impact on fish population in that sound. It is possible that northwesterly winds which occur frequently during the December - June recruitment period may have a negative impact on transport into Albemarle Sound. This wind field would tend to increase water transport from the ocean into Pamlico Sound (Pietrafesa and Janowitz, 1988) but might drive surface waters away from Croatan Sound. This wind might also tend to tilt water level in Albemarle Sound upwards towards the east and so drive water at all depths from Albemarle into Pamlico Sound; hence we might postulate that the hydrodynamics coupling between the sounds is not favorable for abiotic larval recruitment in Albemarle Sound. We shall test this hypothesis while determining the actual hydrodynamic coupling mechanisms between the two major sounds.

SHELL DISEASE IN BLUE CRABS FROM THE ALBEMARLE-PAMLICO ESTUARY

by Edward J. Noga(1) and David P. Engel(2)

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Landings of blue crabs in the Pamlico River have been steadily declining since 1984. One factor which might be influencing this decline is shell disease, which has recently reached epidemic proportions. This disease has been most commonly associated with a bacterial infection of the shell, and can ultimately lead to death of the crab. While shell disease has been linked to poor water quality, there is no information as to why pollution increases susceptibility. This project will adddress that problem by examining the natural bacterial-fighting ability of healthy blue crabs and comparing it with that of individuals with shell disease. We will look at both the ability of these crabs to kill bacteria and to inhibit the destructive chemicals which they produce. Demonstrating differences in bacteria-fighting ability of healthy versus diseased crabs may allow the development of methods of determining when crab populations are stressed. This, in turn, may facilitate the identification of pollutants that may be contributing to the induction of shell disease.

EFFECTS OF WATER MANAGEMENT AND LAND USE PRACTICES ON HYDROLOGY AND WATER QUALITY IN THE ALBEMARLE-PAMLICO REGION

R.W.SKAGGS AND J.W. GILLIAM

The hydrology and runoff water quality from the poorly drained soils of the APES region are significantly affected by land use, drainage and related water management practices. Our research will evaluate the effects of alternative land uses and water management practices on peak rates of runoff, total runoff and water quality from watersheds in the coastal area. For example, we will investigate the effects of changing land use from row crop agriculture to forestry for a given watershed. We will also look at the effects of going the other way, from say 30% ag., 70% forestry to 70% ag., 30% forestry. The effects of water management practices such as controlled drainage will also be analyzed. What happens, for example, to the water quality from a 10,000 acre watershed when control structures are placed in the drainage outlets of all the farmed areas? What would be the effect on peak outflow rates and water quality if the present drainage system, which is primarily for surface drainage, is replaced by a good subsurface drainage system?

Our approach will be to select a watershed in the APES region of about 10,000 to 20,000 acres for intensive study. Hopefully one of the watersheds on which field data are now being collected in other APES studies will be suitable for our purposes. We will then survey available data sources, document and map land uses, soils, and drainage system facilities on the watershed. Then using field data and models developed in several previous studies in the region, we will evaluate the effects of alternative land uses and water management practices. Where possible we will compare predicted watershed outflows and pollutant loadings to measured values on the same watershed.

Our hypothesis is that alternative drainage and land use practices can be selected to significantly affect the rate and quality of freshwater draining into the estuary. Furthermore, models and data from previous studies in the region can be used to evaluate the effectiveness of such practices. Since the impact of a given practice depends on the site, soil and crop parameters,it is necessary that they be evaluated for specific, large watersheds. That is the goal of this study.

Public Participation

NORTH CAROLINA COASTAL FEDERATION

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A CITIZEN'S GUIDE TO COASTAL WATER RESOURCE MANAGEMENT

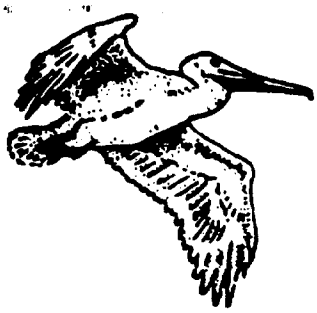
A Citizen's Guide to Coastal Water Resource Management serves as a resource document for citizens who want to become active and effective participants in managing our coast. The book served as resource material for a series of two day workshops that were held in Edenton, Washington, Beaufort and Nags Head and for two field trips held in Dare and Carteret counties. Approximately 1,100 books have already been distributed. A total of 150 people attended the workshops and field trips, including local government officials, developers and their consultants. State and federal resource management agencies took an active educational role in presenting their management programs at the workshops.

The guidebook is designed to help citizens develop an understanding of the laws and regulations that govern our coastline. It is written from the perspective and experience of citizens who have learned how to contribute to and improve our coastal management process. The guidebook begins with a chapter that summarizes the general concepts of regulatory programs and the basic principles of public participation.

A complex combination of federal and state laws form the basis of North Carolina's coastal management program. The guidebook explains the most notable of these laws including the federal Clean Water Act first enacted in 1972, the N.C. Coastal Area Management Act of 1974 and the N.C. Sedimentation and Pollution Control Act of 1973. Four chapters of the guidebook are devoted to water quality standards, coastal management, wetland management, and sediment and erosion control. Opportunities for effective public participation for each of these management efforts are identified. The final two chapters of the guidebook describe other regulatory and nonregulatory programs that also apply in the coastal region.

The guidebook is a product of five years of experience by the North Carolina Coastal Federation. It was written by staff members Jim Kennedy and Todd Miller. Contributing to the book were Lundie Spence, Walter Clark and Kathy Hart of the University of North Carolina Sea Grant College Program. They helped in developing the book's content and served as editors.

Active citizen involvement in managing our coast is a priority of the Albemarle-Pamlico Estuarine Study. To that end, the study provided the financial support necessary to develop the guidebook as well as conduct the workshops and field trips.



NORTH CAROLINA COASTAL FEDERATION

1832 J Bell Lane (Ocean) • NEWPORT, NORTH CAROLINA 28570 • (919) 393-8185

ALBEMARLE-PAMLICO PRESS TOUR

The North Carolina Coastal Federation in conjunction with Duke University Marine Laboratory organized a three day press tour last April. The bus trip began at Duke Marine Lab. Stops were made in Ocracoke, Buxton, Avon, Manteo, Englehard, Lake Mattamuskeet, Swan Quarter Wildlife Refuge, farm fields between Swan Quarter and Washington, Washington, Texasgulf, and forest managed by Weyerhaeuser. In addition, travel time on the bus was devoted to talks regarding on-going APES projects, growth management and sea level rise, taxes, land ownership, water management, sea turtles, and surface and groundwater hydrology.

There were three objectives of the tour:

(1) Develop more indepth understanding about coastal issues among press members for their future reference when covering coastal stories;

(2) Generate immediate publicity about the Albemarle-Pamlico Estuarine Study to help the public better understand what it is all about;

(3) Provide a project that a broad range of interests could come together to accomplish.

The tour succeeded on all three objectives. Regarding the first two objectives, just about every major newspaper in the state participated in the study as well as the Washington Post. In addition, local papers covered portions of the tour that occurred in their communities. Television stations from Greensboro, Raleigh and Washington also participated. Many of the reporters are assigned to cover environmental stories, and they all indicated that the trip was worthwhile in developing a better understanding of coastal issues.

In regards to the third objective, the tour succeeded because of the cooperation and ability of a diverse group of interests all to work together. Every effort was made to present all sides of each issue examined. It took the involvement of fishermen, farmers, scientists, businessmen, industry representatives, and government officials to plan and conduct the tour. The tour provided one of the first opportunities ever for these different interests to work together. This should assist later when these interests are asked to do their part to implement the Comprehensive Management Plan to be developed by the Albemarle-Pamlico Estuarine Study.

CITIZEN MONITORING: PILOT PROGRAM ON THE TAR-PAMLICO
Completion date: October 1988

ABSTRACT The Pamlico-Tar River Foundation (PTRF) designed and implemented a pilot program for water quality monitoring using volunteers in the Tar-Pamlico basin.

In planning the program, PTRF solicited input from the Policy, Technical and Citizen Advisory Committee of the Albemarle-Pamlico Estuarine Study, as well as N.C. agency water quality professionals. To insure scientific validity, a support committee of area scientists was consulted. A final facet of the planning was an exhaustive review of existing lay monitoring programs. The Citizen Program for the Chesapeake Bay (CPCB) was adopted as a prototype.

We have equipped and trained 16 volunteers who began collecting samples in April, 1988, at nearshore sites in the Tar-Pamlico and its tributaries. We have also introduced the program and methodology to other interested parties in the APES region. Water and air temperature are determined with a field thermometer; ph, with a wide-range color comparator kit; dissolved oxygen, with a micro-winkler titration kit; salinity by means of a specific gravity hydrometer; and turbidity or limit of visibility, by means of Secchi disk depth measurement.

At the upstream, fresh water sites salinity is not measured, but nitrate-nitrogen and phosphate are, both by use of color comparator kits. Each monitor follows strict procedures and records their test results on a standardized form. The form is mailed to the project coordinator for verification and entry into a computer file.

Quality assurance began with informed planning and continues through every aspect of the program. Each volunteer was initally trained at a workshop held in late March. Follow-up calls are made to the monitors to answer questions and discuss any problems. In addition, on August 6, we had a "quality control session" workshop wherein we reviewed and tested policy and proceedure. Fourteen of our sixteen stations have been functioning virtually flawlessly. We intend to remedy the problems at two of our sites.

During the year, the concept of this program has captured the imagination of people throughout the estuarine region; therefore, it has been targetted for future APES funding on a larger scale. PTRF has been determined to be the best agency to administer the formative stages of the program. We have already contracted with a qualified individual to carry out the obligations and duties of a full-time project coordinator. The program expansion (to include the entire APES region) began on October 1, 1988.

PUBLIC PARTICIPATION PROJECTS
Radio Reports, Video Public Service Announcements, Radio Public Service Announcements, State of the Estuary Booklet

Work performed by the Environmental Resource Project located at UNC-CH's Institute for Environmental Studies
Contact Person: Melva Okun (919) 966-3332

To enhance citizen input, interested community members need useful and relevant information. To this purpose the Environmental Resource Project agreed to develop educational materials on topics pertaining to the Albemarle Pamlico Estuarine Study Project.

Radio Reports: Five radio reports were produced by Melva Okun, the science producer for WUNC radio, the National Public Radio member station in Chapel Hill. The reports covered: declining water quality; changes in fishing conditions; growth issues on Ocracoke Island; growth on Hatteras Island; and the Cedar Island Ferry as a connector in the tourism industry. The reports consisted of interviews with locally involved citizens, state government representatives, environmental leaders, and business representatives. The reports were also made available to WHQR in Wilmington, and WTEB in New Bern.

Video Public Service Announcements: Four video spots for television broadcast were produced by Melva Okun. The video spots cover the following topics: a commercial fisherman commenting on changes on the Pamlico; a farmer commenting on Best Management Practices; a citizen talking about working with the citizen water monitoring project; and a fish house operator describing the need for all concerned parties to work together. Television stations throughout the APES area have agreed to air the spots. Upon completion of changes, the spots will be distributed to the stations.

Radio Public Service Announcements: Ten interviews were conducted by Melva Okun with representatives of business and industry, citizen groups, environmental leaders, institutional leaders, and commercial fishermen. Those interviewed commented on concerns for the Sounds of North Carolina and why it is important for the public to be involved. Final editing of the pieces is being completed at which point they will be distributed to identified commercial radio stations in the APES area.

State of the Estuary Booklet: Frank Tursi, journalist with the Winston-Salem Journal, is writing a booklet about the Sounds of North Carolina. The booklet will describe what an estuary is, the resource it provides, what signs of distress are presently being noted, and how the public can be involved. The booklet will be distributed to the public.

VIDEO AND SLIDE PRODUCTIONS OF THE ALBEMARLE-PAMLICO SOUND

by Dr. Gary C. Smith, East Carolina University

The effective dates of my grant are from March 1, 1988 to March 1, 1989. The dual-projector dissolve slide program I am developing will be approximately 25-30 minutes long. Primary focus is on the watersheds flowing into the sound area. I will trace water from the mountains of N. C. and Va. as it moves down creeks and rivers and into the sound. Each ecosystem the water flows through will be highlighted. Recreation, pollution problems, and natural resource management will be emphasized. At this point in time (mid September) I have completed most of the photography for the slide program. I will be adding a few more slides of pollution and resource management. The U. S. Fish and Wildlife Service at Mattamuskeet Wildlife Refuge shared slides from their file for this production. A written script in rough form has been completed.

The video production of approximately one half hour duration will follow the same format as the slide program. At this point, I have good sequences of all natural ecosystems completed and will focus on pollution, fisheries, and waterfowl migrations this fall. Channel 7 (WITN) in Washington, N. C. is sharing some excellent aerial footage and special feature material on the Sound for inclusion in this production. I am presently organizing a series of interviews which should be completed in October. These will be edited into the production.

A survey questionnaire which I administered to the C.A.C.'s and other organizations in Eastern N. C. helped me to identify interviewees, critical habitats, and pollution problems that are being included in both the slide and video productions. Special editing, titling, and graphics will be completed by the Communications Media Department of the E. C. U. Health Sciences Division in the early part of 1989. I am working closely with several members of the Citizen's Advisory Committees on these projects.

ALBEMARLE-PAMLICO ESTUARINE STUDY

PUBLIC AWARENESS MEETING
November 14, 1987

ABSTRACT

Dr. Maurice Powers and Dr. John Carson initiated and organized a public awareness meeting concerning the Albemarle-Pamlico Estuarine Study. The meeting was held at Elizabeth City State University on November 14, 1987.

Purpose of the meeting was to highlight the coastal waters study in terms of management systems, needed investigations and public concerns. Panel sessions, consisting of experts from federal and state agencies and private citizens, addressed different aspects of estuarine problems. These included water pollution, aquatic life deteriotion, habitat destruction and nutrient buildup in coastal waters.

About three hundred people attended the meeting, representing the entire Albemarle-Pamlico region. Federal and state officials from Atlanta, Washington, Raleigh and numerous other agency headquarters were present to discuss problems and offer opinions. The Albemarle and Pamlico Citizens' Advisory Committees were invited to take part in the meeting.

From Sound to the Sea: Journey of the Striped Bass

North Carolina Aquarium on Roanoke Island

Environmental and economic problems of the Albemarle and Pamlico Sounds are interpreted through the Striped Bass, Morone saxatilis in this major exhibit at the North Carolina Aquarium on Roanoke Island. The life history of the striped bass is described and related to environmental stresses which are affecting the natural migratory cycle of these fish. Movements of mature adults are followed in display format as they travel from the ocean, through the inlets and sounds into freshwater rivers. Spawning activities and the development of the young are traced along their return route to the ocean. The importance of salt marsh nursery areas are emphasized. The information will be presented using interpretive graphics, interactive computers, and a 1100 gallon aquarium to house live specimens. Over 500,00 people per year will view this exhibit. This project is sponsored by the North Carolina Aquarium Society, a private non-profit association organized to support educational activities at the North Carolina Aquariums.

GUIDE TO STREAMWALKING: AN ESTUARINE COMPANION

ABSTRACT

GUIDE TO STREAMWALKING: AN ESTUARINE COMPANION

This project dovetails nicely with the public education goals of APES; it will create an effective avenue for dissemination of information about the estuarine system and the work of the Study. The Guide to Streamwalking is an excellent booklet, written for adults but in common parlance; unfortunately, it is not applicable to our estuarine region.

As noted in the review of APES first year effort, the revision of Streamwatch's, "A Guide To Streamwalking", into a text relevant for use in estuarine areas, is a high priority item for public education in APES.

The format and design of the original need not be altered; however, the current text and artwork pertains to freshwater streams and will be revised and made relevant to estuarine systems in general, and to the Albemarle/Pamlico in specific.

We propose to develop the revision; the current proposal does include funding to subcontract for printing and publishing 500 copies.

COMMUNITY EDUCATIONAL OUTREACH

ABSTRACT

COMMUNITY EDUCATIONAL OUTREACH:

The Albemarle/Pamlico Estuarine Study acknowledged the value of substantial existing research and data bases. At the outset of APES, the study began an inventory and catalogue of existing information and research so that it might not fund redundant efforts. In analogous fashion, PTRF recognizes the existence of many fine educational materials: booklets, maps, exhibits, audio-visual aids, posters, etc. Therefore, to avoid the production of repetitious materials, we propose to begin our education outreach with an inventory of these materials.

While developing the inventory, PTRF would establish a speakers bureau catalogue so the authorities on various subjects related to estuarine resources and their management might be easily identified and contacted by citizen's groups, schools and civic organizations.

The heart of the proposal is not the collation of these materials, but rather, is the presentation of them in the public arena. The obvious place to begin public education is in the schools. We propose to target the schools in Pitt and Beaufort Counties; even, this limited scope is a formidable challenge as there are 47 schools and over 26,000 students in these two counties.

There is little doubt that such a task alone could consume the energy of one or two full time educators. PTRF is fortunate to have a cadre of volunteers on an education committee to assist in this outreach program. A part time staff person would work with this committee to carry the presentation into as many of the classrooms as possible through the year.

The presentation would teach students about the ecology and resources of the estuary, the issues and problems of estuarine resource management and would highlight the APES program and other vehicles through which the students can contribute to the protection of the region.

In addition to the schools, the presentation would be delivered to civic clubs, citizen organizations, youth groups, scout troops and in a variety of public festivals in the watershed.

All other projects aside. personal, direct communication is the most efficient avenue to public education. This project is the perfect complement to the APES project and is perhaps the simplest way to accomplish both of the aims of APES' public involvement funding. It will assist APES as an "effective avenue for disseminating information about the study; and (by) obtaining regular advice and input from the public concerning APES activities".

EDUCATIONAL CALENDAR: YEAR 1990

ABSTRACT

EDUCATIONAL CALENDAR: YEAR 1990

This project dovetails nicely with the public education goals of APES; it will create an effective avenue for dissemination of information about the estuarine system and the work of the Study. An aesthetically pleasing calendar that simultaneously conveys clear information will be a valuable tool. Although, it will transmit only a small piece of information, the calendar will reach a broad cross-section of regional people who might otherwise remain unaware of the purpose or even existence of APES or the problems.

We propose to design and develop a 12" x 12" (dimension approximate) full color wall calendar. The calendar will be designed for the year 1990 and 5000 copies should be available for distribution by July 1989. The calendar will feature 13 full color photographs (1 for each month plus a cover photo); it will be spiral bound. Paul Nurnberg, a professional photographer whose studio is in Washington, NC, will solicit and collect appropriate photographs from throughout the region. He proposed to conduct a competition (selected photos will receive cash awards). Ten winning photos will be included in the calendar along with three of his own creation.

PTRF's education committee will develop two or three lines of text to underscore each month's photo. The text will apprise the audience about issues in estuarine resource management.

Printing and spiral binding of the calendar will be sub-contracted with Chip Henderson of Lightworks, 6005 Chapel Hill Road, Raleigh, NC.

Paul Nurnberg is a highly trained photographer who owns and operates a studio in Washington, North Carolina (BS in Professional Photography, 1980, Rochester Institute of Technology, 7 years professional experience). (portfolio available for review)

Whiting Toler is a commercial artist from Blounts Creek, North Carolina who has considerable experience in the visual representation of scientific concepts (BS Art East Carolina University 1969, 15 years of experience as a technical/commercial artist: including collaborations with the Smithsonian Institution, the planning group from North Carolina Phosphate Corporation, science departments at ECU and Duke Marine Lab, NCSU Sea Grant, and Science Magazine.

Chip Henderson (7 years of experience in graphics) and his company Lightworks (3 1/2 years) will print and bind the calendar. They have previously produced 4 calendars and have one currently in production.

ABSTRACT OF

TEACHER ENVIRONMENTAL EDUCATION PROGRAM

This program will establish a series of teacher workshops in the cities of Elizabeth City (February 11, 1989), Edenton (March 11, 1989), Plymouth (April 8, 1989), and Manteo (May 13, 1989), concerning aquatic environmental management in the Albemarle-Pamlico Estuarine System.

In the first phase of the program, we will develope a slide presentation for presentation to public school faculties in the Fall of 1988. At the same time, we will provide the teachers with applications for the workshops. This exposure will help encourage participation in the workshops. In addition, Mrs. Wendy Allen of the Northeast Regional Education Center, will work very closely with us in establishing the workshops and encouraging teacher participation.

In the second phase, the workshops will be conducted on Saturdays from 9:00 A.M. to 4:00 P.M., and will be led by scientists and educators with the relevant environmental background. Each participant will receive a stipend of $20.00, in addition to lunch. These benefits, plus a renewal credit, will maximize the probability of participation by relevant area teachers. Each workshop will be limited to forty (40) participants.

Each workshop will be divided into morning and afternoon sessions, with the morning session devoted to the basic understanding of the aquatic environment and its management. The afternoon session will divide participants into smaller groups led by consultants who will lead a discussion concerning the integration of the subject into particular classroom enfironments, the development of class projects and the development of lesson plans.

Following the group meetings, a wrap-up session will bring all of the information together with a general discussion of techniques and strategies for the presentation of aquatic environmental information in the classroom.

The final element of the workshops will involve projects and lesson plans which each participant will be responsible for completing and returning to the instructor.

A written report on each workshop will be submitted to the Albemarle-Pamlico Study with regard to the names of participants and the names of workshop leaders and consultants. A written evaluation will also be submitted by each workshop leader.

Human Environment

Title: "The State of the Estuary" Television Public Service Announcement Campaign.
Duration: January 1989 to January 1990
Principal Investigator: Lib Willard, Lisabeth Willard Productions.

The "State of the Estuary" public service television campaign will bring the North Carolina sounds into virtually every home in North Carolina at an estimated cost of less than a penny per viewer. Five thirty-second television spots, airing over twelve months will focus on general education, the study itself, and citizen involvement.

Preliminary Outline "State of the Estuary" Television Campaign

Spot One: An introduction to the North Carolina sounds and the Study. this spot will run the entire length of the campaign. It will define the sounds, what an estuary is, and the importance of good stewardship.
Air dates: January 1989 to January 1990.

Spot Two: Man and Water. This spot looks at mans affect on the sounds, the sink basin for vast amounts of water originating hundreds of miles away. Herbicides, pesticides, the wastes of modern man end here.
Air Dates: March 1989 to June 1989.

Spot Three: Stress. This spot looks at the symptoms of stress: nutrient enrichment and algal blooms, dead water, fish and crab diseases, and the disappearance of seagrasses.
Air Dates: May 1989 to August 1989.

Spot Four: The Pamlico-Tar River. A personal look at the plight of this river. Air Dates: August 1989 to November 1989.

Spot Five: We are all responsible. This spot details the importance of citizen involvement in preserving the North Carolina estuaries.
Air Dates: October 1989 thru February 1990.

Scripting and production will begin by November, with a first air date of January 1989.
In cooperation with: North Carolina Association of Broadcasters, North Carolina Coastal Federation, Duke University Marine Laboratory, Pamlico-Tar River Foundation, North Carolina Fisheries Association.

Lisabeth Willard Productions. 3010-g Walnut Creek Pky., Raleigh, N.C. 27606. 919-859-2624

CITIZEN W-Q MONITORING 1988-89; PTRF

ABSTRACT:

Water quality monitoring by volunteer citizens is an excellent and meaningful way of incorporating public participation into APES. Management of estuarine resources will ultimately prove more effective if the general public better understands the subtle dimensions of the problems and proposed solutions. The project will not only provide credible data to the Study but will also increase public involvement and education.

We propose to continue the citizen monitoring program established in this year's pilot program on the Pamlico-Tar River. As the program expands geographically, we will explore the possibilities of expanding the extent and sophistication of the data collection as well. In addition to the baseline water quality data collected, the monitors will be trained to make routine sociological and meteorlogical observations a part of their report.

We have modeled our program on the Citizen's Program for the Chesapeake Bay. We believe a program of approximately 50 stations would adequately involve the interested organizations of the region and could be implemented by a single staff person.

The Pamlico-Tar River Foundation (PTRF) will appoint a steering committee to supervise the project. The steering committee will facilitate the efforts of a fulltime project coordinator, and will serve as liason to individual volunteers in the various watersheds of the APES region.

PTRF will assist the steering committee during the formative stages of the project; through the hiring of staff and in the development of policy and procedure that will structure the program. It is, however, the intent of PTRF that involvement by us will gradually diminish as the steering committee assumes more responsibility.

The steering committee will include representatives from each of the citizens groups that foster monitoring projects in their watersheds. We have already received verbal endorsement for this proposal from most of the groups. For the program to succeed, it must have the support of North Carolina's state water quality authority. Their assistance in establishing quality assurance and quality control are necessary to insure that the citizen's efforts are viable. The committee will include two employees of the state. The recently established PERT (Pamlico Early Response Team) is dedicated to close interaction with the public; this unit is comprised of four individuals, any of whom could ideally serve on the committee.

The person employed as coordinator will be responsible for materials acquisition and training programs throughout the APES study area. She will also collate the data and transmit it to APES for storage. The office will be in Washington, NC at the PTRF office; the coordinator will develop and maintain volunteer data collection, publicize the findings and work with state officials to unify citizen data with agency monitoring efforts.

CHARACTERIZATION OF BASELINE DEMOGRAPHIC TRENDS IN THE PERMANENT AND TEMPORARY POPULATIONS IN THE ALBEMARLE-PAMLICO ESTAURINE STUDY AREA.

Paul Tachetter
Department of Sociology and Anthropology
East Carolina University
Greenville, NC 27858

This project was designed to provide baseline demographic data and trends for the populations of the thirty-three county Albemarle-Pamlico Estaurine Study (APES) area. Two types of populations are identified. The first is the permanent population which is the count of people for whom a particular community is their usual place of residence. The second is the temporary recreational population, more specifically, the count of the overnight tourist population. The total estimated population for a community is the sum of the permanent population and the overnight population. The estimates were developed using the county as the unit of analysis.

Permanent population counts are available for census years. Post-censal estimates are developed using data on changes in the number of residential electric meters.

Estimates of the temporary population are developed by seeking counts of four different types of overnight facilities. First, the number of motels/hotels and the number of motel/hotel rooms are counted. Second, the number of campgrounds and campsites are counted. Third, the number of marinas and boat slips are counted. The data for these three types of facilities came from secondary sources plus additional on site inspection. The fourth type of overnight facility is the private recreational housing unit. Counts of private recreational housing are based on data from the Census of Housing. Estimates of the recreational population are developed using multipliers reflecting the average number of persons per motel room, campsite, boat slip, and housing unit.

In developing estimates, counties were ranked by the number of different types of recreational facilities they possess. Overall, Carteret and Dare Counties had the highest level of recreational activity. Other counties identified as having significant amounts of one or more type of overnight recreational facility are Beaufort, Currituck, Craven, Hyde, Pamlico, and Perquimans.

The estimates indicate that the prime coastline recreational counties have experienced significant growth during the 1980s. During the 1980s the most significant increases have come in private recreational housing, motels/hotels, and marinas. There has been, if any, increase in campgrounds during the decade.

UNC SEA GRANT COLLEGE PROGRAM

Box 8605
105 1911 Building
North Carolina State University
Raleigh, North Carolina 27695-8605
919 737-2454

M E M O R A N D U M

TO: Bob Holman

FROM: Walter Clark WC

SUBJECT: APES Review Meeting
October 14 - Washington, NC

DATE: August 29, 1988

North Carolina's Estuaries:

A Pilot Study for Managing Multiple Use in the State's Public Trust Waters.

North Carolina's Coastal Area Management Act clearly states that the management of water areas, especially estuarine waters, is important in achieving the balanced use and preservation of the state's coastal resources. However, CAMA, through its dual program of regulation and planning, has, to date, focused on land and wetland management. In other words, the program has given little attention-particularly through the program's planning component-to the implementation of a comprehensive management scheme for estuarine and public trust waters. Yet, conflicts between public trust users in the state's estuarine waters are drastically increasing in the face of growing population and development.

This proposal suggests the development of a management scheme for estuarine waters using the model of state and local cooperation set up under the CAMA. The scheme will be tested through a pilot study that will focus on a single coastal county's jurisdictional waters.

The study will involve; (1) mapping resource and use areas in the county's estuarine waters-i.e.-shellfish beds, areas heavily used for recreational, purposes ect. The services of the state's Land Resources Information computer mapping program will be utilized; (2) the development, using the resource maps, of a water use plan. This will be an extension of the CAMA's land use planning program; (3) the development of local ordinances utilizing the water use plan, state regulations and local water use goals and desires.

At the conclusion of the project the results will be taken to the other coastal counties through a series of workshops.

This study is relevant to the Albemarle-Pamlico Study goal of providing information needed to make rational management decisions.

PROJECT TITLE/PERIOD OF PERFORMANCE:

Evaluation of Environmental Management and Resource Protection Programs in the Albemarle-Pamlico Region / August 1988 through July 1989

PRINCIPAL INVESTIGATOR:

Robert Nichols, Research Triangle Institute, RTP, NC

PROJECT ABSTRACT:

This project will assess the effectiveness of existing policies and management programs that address water quality in the Albemarle-Pamlico region. The framework of implementation analysis (as developed by Daniel Mazmanian and Paul Sabatier) will be used to evaluate individual programs, with an emphasis on State management activities. Programs to be investigated include those that regulate pollutant-generating activities (e.g., municipal and industrial point sources, marine waste disposal, stormwater runoff, agricultural and forestry practices and Defense Department activities) and resource consumption acitivities (wetlands development, shellfishing, and finfishing).

Implementation research examines the way in which policies and programs conceived at one level or branch of government (usually in a statute) are translated into specific actions at another level and achieve certain impacts on target groups. Success is evaluated using specific criteria that have been shown to promote effective implementation. The six criteria to be used under this project are:

1. Enabling legislation or other policy directives that set clear and consistent objectives
2. Enabling legislation or regulations that are based on a technically sound theory concerning what actions will result in achievement of the desired objectives
3. Adequate resources and program structure that will maximize the potential for achieving desired objectives
4. Implementing agency leaders that possess substantial managerial and political skills and are committed to the program goals
5. Active support of interest groups, constituency groups and key legislators
6. An environment where the relative priority of statutory goals is not undermined by conflicting policies or changed conditions.

A final report will (1) evaluate the effectiveness of critical environmental management programs (2) evaluate the overall effectiveness with which existing programs address use-conflicts in the region; and (3) where necessary, propose changes that may improve the effectiveness of both individual programs and the overall structure of resource management in the region.